

COMPOUND STOOL WITH ENERGY STORING SPRING

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Be it known that I, Richard D. Knowles, a citizen of the United States and a resident of the City of Spokane in Spokane County and the State of Washington, whose post office address is 1743 North Regal Street, Spokane, Washington 99207, have invented certain new and useful improvements in COMPOUND STOOL WITH ENERGY STORING SPRING of which the following is a specification for which I pray the issuance of Letters Patent.

II. BACKGROUND OF INVENTION

IIA. RELATED APPLICATIONS

5 There are no applications related hereto heretofore filed in this or any foreign country.

IIB. FIELD OF INVENTION

10 My invention relates generally to chairs or seats and more particularly to a compound stool having a compression spring between a base and a relatively movable seat structure which may move vertically to aid a user's ingress on and exit from the stool.

IIC. BACKGROUND AND DESCRIPTION OF PRIOR ART

15 Stools have long been used for support of a seated user and, though their developmental period has been long and the state of their development has become sophisticated, there still remain unsolved problems with present day stools. The instant stool solves some of 20 those remaining problems by providing a relatively low seat structure that moves vertically to allow a seated user to easily work on a surface supporting the stool, while yet providing auxiliary supports and associated 25 spring structure to store energy generated by a seated user to aid the user in entering, using and exiting the stool.

The height of seating surfaces for supporting an average user in a seated posture varies widely from

about 4 or 5 inches to more than 40 inches above a supporting surface, the latter of which height may require an auxiliary step or some similar device to allow a user to enter on the seating surface. The 5 average height of ordinary seat support surfaces is approximately 18 to 20 inches above a supporting surface, but it often is difficult for some users of seating devices to gain a seated position even on such seat support surfaces. This difficulty tends to increase 10 in proportion to the distance that the seat support surface varies from the average seat support height and is enhanced by any physical decrepitude that the user may have, such as from age or infirmities.

A seat support for a person working on or at the 15 level of the surface supporting the seat support must of necessity provide a support surface at a relatively low height, usually about 12 to 14 inches or less, to allow a seated person to conveniently access the seat supporting surface. This is particularly true for 20 persons working on or near a floor or gardeners working in the surface of the earth. Such lower seating devices provide particular problems and challenges for a disabled or infirm user as they are particularly difficult to both enter and exit. The instant device 25 provides a stool type support that has a vertically movable seat structure that may be entered at a raised position to subsequently move downwardly responsive to the user's weight by reason of bias created in a

supporting compression spring beneath the seat structure which stores the energy creating its bias to subsequently release that energy when the user gets up from the stool to aid the user's exiting motion.

5 The difficulty in entering, using and exiting relatively low seating devices has heretofore been recognized and responsive various solutions have been proposed, including the use of compound seating devices having a seat structure that is at least somewhat vertically movable relative to a supporting base with associated spring structure that is affected by vertical motion of the seat structure in some fashion. Several 10 devices incorporating such structures have been associated with seats in vehicles or other moving support mechanisms to act as shock absorbers to lessen vertical inertial motion of a seat carrying a user responsive to rapid change in vertically orientated motion of the vehicle or other support mechanism carrying the seat. These shock absorbing devices 15 distribute inertial forces over both a greater distance and a greater period of time than would result without the shock absorbing device, to both physically and psychologically lessen the effects, or at least the perceived effects, of shocks. Most such shock absorbing 20 seat structures have relatively strong springs that allow only slight spring motion responsive to relatively large impressed forces to effectively accomplish their purposes. The instant invention is distinguished and 25

teaches away from this type of shock absorbing seat in
that the instant invention provides substantially
greater linear motion of the spring supporting the seat
support responsive to a similar force to allow the seat
5 to move a substantially greater distance from its null
position than would a shock absorber. The kinetic
energy created by such spring motion is stored in the
spring to allow that energy to be released as the seated
user exits from the seat support to aid that exiting
10 motion.

Various other devices have moved a seat supported
for vertical motion either by motor powered mechanisms
or indirect action of spring mechanisms to aid entry,
exit or both to and from the seat.

15 Such devices that are motorized are distinguishable
from the instant stool by reason of its use only of a
simple compression spring to accomplish its purposes.
The motorized devices generally have been concerned with
regulation of the height of the seat to an adjustable
20 position where, after adjustment, the seat remains until
again moved by its powering mechanism. In
contradistinction the instant seat support moves
automatically each time a user enters, exits or changes
the amount of his weight supported on the seat support.

25 Such devices that have used springs to aid entry or
exit from a seat generally provide a compound structure
including levers, bell cranks and the like to accomplish
their purpose, whereas the instant mechanism uses merely

a simple compression spring which is more reliable and durable with no parts that move relatively to wear or require maintenance by reason of their movable engagement. The instant seat support has relatively linear motion substantially directly proportionate to the applied force through its operative range, whereas compound spring structures generally provide seat motion that is not directly proportionate to applied force. The instant spring in contradistinction from prior devices provides adjustment to allow convenient use by persons of differing weights by adjustment of the tension in the seat supporting spring when the seat support is in a null position. To accomplish this function the spring is contained in a chamber between a top and a bottom spring support that is adjustably movable toward and away from the top to regulate biasing force in the spring when in a null position extended between the top and spring bottom support.

The structure of prior spring moved seats to aid entry and exit often has provided a forward tilting motion of the seat while moving upwardly. The instant seat in contradistinction moves the seat support vertically upwardly, with very little if any tilting motion in any direction, to make the motion safer and more adaptable for use by persons lacking agility and balance to accommodate to tilting seat motion.

The instant stool also provides associated ancillary support structure for a user to aid in

5 maintaining balance, aid entering and exiting the seat structure and aid in determining user position prior to and after entering and exiting the seat structure, all in distinction from prior spring operated seating devices that in general have not provided such ancillary support structure.

10 My invention lies not in any one of these features individually, but rather in the synergistic combination of all of its structures that give rise to the functions necessarily flowing therefrom.

III. SUMMARY OF INVENTION

15 My stool provides a peripherally defined truncated conic base defining an internal chamber and carrying plural depending support wheels and external upstanding user support structure. The internal chamber carries a bottom spring support plate for adjustable vertical positioning above the chamber bottom with a compression spring supported between the bottom spring support and an upper spring disk biased against the under surface of the truncated top of the base. Seat support structure positioned spacedly above the base provides plural depending support rods movably communicating through the base top to the upper spring disk therebeneath to move the upper spring disk responsive to vertical motion of the seat, which responsively vertically moves the compression spring. Fastening mechanism carried by the base top releaseably fastens the seat support structure

in a lowermost position, spacedly above the truncated top of the base.

In creating such device, it is:

A principal object to provide a stool having a base supporting a seat support structure extending spacedly thereabove for vertical motion biased to an upwardmost null position.

A further object is to provide such a stool having a base defining an internal chamber carrying a compression spring which moves vertically responsive to vertical motion of the seat structure to store kinetic energy that is releasable on upward motion of the seat to aid a user in exiting from the stool.

A further object is to provide such a stool having a compression spring that moves downwardly responsive to a user's weight on the seat to allow a user to enter the seat at a higher position and move the seat downwardly by his weight to be ultimately supported below the entry level to allow easier user access to an underlying surface supporting the stool.

A further object is to provide such a stool with at least three wheels supporting the base for motion on a supporting surface when not supporting a user and for positional maintenance on the supporting surface when supporting the user.

A still further object is to provide such a stool with similar paired laterally opposed upstanding side supports to aid a user in entering on and exiting from

the seat support.

A still further object is to provide such a stool that has latch mechanism to releasably maintain the seat support in a lowermost position, spacedly above the truncated top of the base.

A still further object is to provide such a stool that is of new and novel design, of rugged and durable nature, of simple and economic manufacture and one otherwise well-suited to the uses and purposes for which it is intended.

Other and further objects of my invention will appear from the following specification and accompanying drawings which form a part hereof. In carrying out the objects of my invention however, it is to be understood that its essential features are susceptible of change in design and structural arrangement with only one preferred and practical embodiment of the best known mode being illustrated in the accompanying drawings and specification as is required.

IV. BRIEF DESCRIPTION OF DRAWINGS

In the accompanying drawings which form a part hereof and wherein like numbers of reference refer to similar parts throughout:

5 Figure 1 is an isometric rearwardly looking view of my stool showing various of its parts, their configuration and relationship.

10 Figure 2 is an isometric forwardly looking view of the stool to further show its parts, their configuration and relationship from this aspect.

15 Figure 3 is a slightly enlarged vertical cross-sectional view through the stool of Figure 2, taken on the line 3-3 thereon in the direction indicated by the arrows, to show internal structure with the fastening mechanism in unfastened position and the external support structure cut away for clarity.

20 Figure 4 is a view similar to that of Figure 3 taken on the cross-sectional line 3-3 and in the direction indicated by the arrows thereon, but showing the fastening mechanism in fastened position.

Figure 5 is an isometric view of the fastening lever of the fastening mechanism, isolated from the stool to show its configuration.

25 Figure 6 is an orthographic top view of the base bottom and associated spring bottom support isolated from the other stool structure to show the adjustable interconnection of the isolated structures.

Figure 7 is a medial vertical cross-sectional view

through the structure of Figure 6 taken on the line 7-7
in the direction indicated by the arrows thereon.

Figure 8 is an enlarged portion of Figure 7 taken
in circle 8 thereon to show the detail of the adjustable
5 fasteners extending between the base bottom and the
interconnected spring bottom support.

V. DESCRIPTION OF THE PREFERRED EMBODIMENT

My stool generally comprises base 10 movably supporting upwardly extending seat structure 11, with spring structure 12 communicating therebetween and support structure 13 carried by the base externally thereof.

Base 10 provides a rigid peripherally defined unitary conic body having right cylindrical conic side surface 14, perpendicular truncating top 15 and somewhat radially larger lowermost base ring 16, all of substantially equal limited thickness to define medial base chamber 17. Annular circumferentially extending support rings 18 are carried in axially spaced relationship on conic side surface 14 to provide additional strength and rigidity for the base structure. Three fastener holes 19 are defined in top 15 in spaced symmetrical array about the conic axis of the base to accept fasteners for a seat support stop disk. Three similarly arrayed seat support shaft holes 20 are defined through the truncated top surface 15 between and radially outwardly from the three fastener holes 19 to accept seat support shafts.

Medial base chamber 17 is enclosed in its lower part by circular bottom disk 21, which preferably is supported with its bottom surface coplanar with the bottom surface of base ring 16 by annular support 22 that fits radially inwardly of the inner surface of base ring 16 and between the lower surface of shoulder 23,

defined at the intersection of conic side surface 14 with base ring 16, and the upper surface of the bottom disk 21. The bottom disk 21 is positionally maintained on the base 10 by Z-shaped wheel brackets 24 having upper horizontal radially outwardly extending arms 24a communicating with medial vertical bodies 24b extending adjacent to the outer surface of base ring 16 to lower horizontal arms 24c extending radially inwardly adjacent the lower surface of bottom disk 21.

Lower wheel bracket arm 24c is fastened to the adjacent portion of the bottom disk 21 by fasteners 25 and the medial body 24b is fastened to the adjacent portion of base ring 16 by fasteners 26 extending therebetween. The upper horizontal arms 24a of each wheel support bracket carry depending caster wheels 27 so sized and positioned that the lower surfaces of the caster wheels 27 depend slightly below the plane of the lower surface of base ring 16 and bottom disk 21. This allows the wheels 27 to provide locomotion over an underlying supporting surface when the stool is in relaxed unloaded mode, but also allows the bracket 24 to resiliently deform when the stool is in its loaded mode to provide stationary or positionally maintaining support on an underlying supporting surface.

The truncating top surface 15 of base 10 carries seat support stop disk 28 spacedly thereabove. The stop disk 28 is supported on three tubular pillars 29 positioned above fastener holes 19 and carrying

fasteners 30 communicating from the stop disk through the channels of pillars 29 and through truncating top 15 for fastening on the under surface of the top to positionally maintain the seat support stop disk 28.

5 The seat stop disk 28 defines elongate fastener slot 31 in its medial portion to receive a seat fastener. The seat stop disk 28 is spaced above the top 15 of the base only sufficiently to allow operation of a seat fastening lever between the stop disk 28 and upper surface of top

10 15.

Seat structure 11 provides rigid seat disk 32 carrying plural depending seat support shafts 33, in the instance illustrated comprising three elongate tubes arrayed symmetrically about the disk axis in such position as to be carried in seat support shaft holes 20 defined in top 15 of the base 10. The lower ends of seat support shafts 33 are carried in holes 34 defined in the upper surface of disk-like upper spring plate 35 carried in medial base chamber 17. The seat support shafts 33 and seat support shaft holes 20 are so configured that the shafts 33 may readily move vertically through the support shaft holes 20. The length of the support shafts 33 is somewhat less than the distance between bottom disk 21 and seat support top disk 28 and, in the instance illustrated about one half of that distance. The seat disk 32, and especially its upper surface, may be covered with external padding (not shown) to provide greater user comfort, according

to principles and practices heretofore known in the chair and stool arts.

5 Seat disk 32 carries depending fastener 36, in the instance illustrated comprising screw shaft 36a having fastening ring 36b in its lower end portion. The fastener 36 is carried in a medial position in the support disk and so oriented that ring 36b will pass vertically through fastener slot 31 defined in seat support stop disk 28 when the seat support disk 32 is sufficiently depressed. Fastening lever 37 is pivotally 10 mounted on the undersurface of the seat support stop disk 28 by fastener 40 for pivotal motion in the space between top 15 of the base and the seat stop disk 28 spacedly thereabove. As seen in Figure 5, fastening 15 lever 37 is an elongate structure comprising body 38 having upstanding finger tab 39 at its radially outer end and defining hole 40a for fastener 40 in its radially inner end with fastening finger 41 in its medial portion angularly outward to engage within 20 fastener ring 36b. The fastening lever 37 is so configured and sized that it may selectively pivot fastening finger 41 to pass within fastener ring 36a and move outwardly from that ring when extending beneath the seat stop disk 28 to provide releasable fastening of 25 seat support disk 32 in a downward position relative to base 10.

Spring structure 12 provides compression spring 42 supported on spring bottom support disk 49 and extending

upwardly to the lower surface of upper spring plate 35. The compression spring 42 illustrated is of a cylindrical even wound type, but if desired for particular biasing results of the seat support disk 32, 5 the spring 42 may assume various other known configurations such as conical or non-uniformly spaced spiral configuration.

The lower end of compression spring 42 may be supported directly on the upper surface of bottom disk 21, but preferably though not necessarily, it is supported on spring bottom support disk 49 to allow adjustment of the compression in the compression spring 42 when it is in a null state without any live load on seat disk 32. As seen in Figures 6-8 the spring bottom support disk 49 is supported spacedly above the bottom disk 21 by four bolt type fasteners 50 with threaded shafts extending upwardly through quadrantly arrayed holes 51 defined in the bottom disk 21. Fasteners 50 are maintained in holes 51 by nuts 52 and extend spacedly thereabove. Washers (not shown) may be carried on both sides of nuts 52 to aid the operation of fasteners 50. The spring bottom support disk 49 carries four support nuts 54 quadrantly positioned therein for threaded engagement on upwardly projecting threaded portions of fasteners 50. The support nuts 54 are of an internal type contained within holes 53 defined in spring bottom support disk 49 and have radially projecting fins (not shown) to aid positional

5 maintenance and to prevent rotation in the holes carrying them. When the support nuts 54 carried in the spring bottom support disk 49 are engaged on fasteners 50 the fasteners 50 may be rotated by manipulating their heads from the outer surface of bottom disk 21 to move the spring bottom support disk 49 relatively to the bottom disk 21 and thusly adjustably regulate the distance between upper spring plate 35 and the spring bottom support disk 49 to determine the null bias in 10 compression spring 42 within limits, depending upon the nature of the compression spring.

15 Preferably to maintain alignment of compression spring 42 within base chamber 17, but not necessarily, disk-like spring support 43 may be carried in a medial position on the upper surface of spring bottom support disk 49 to fit within the lower portion of the compression spring 42. Depending disk-like protuberance 44 also may be provided on the lower surface of upper spring plate 35 to fit within the upper portion of the compression spring 42 for similar alignment purpose. In 20 general however in the preferred embodiment illustrated, the compression spring 42 is large enough that it is sufficiently positionally maintained by the inner surface of base 10 that defines the base chamber 17.

25 Support structure 13 provides two similar diametrically opposed upstanding support loops 45 formed of rigid elongate channel elements and interconnected by arcuate back support 46, all carried by base 10 to

extend about the base periphery to aid a user in entering on and exiting from the stool. Each loop **45** is structurally carried by similar fastening plates **47** fastened on the under surface of bottom disk **21** of the base **10** by fasteners **48** communicating therebetween. Back support **46** is structurally interconnected between the adjacent rearward portions of each opposed support loop **45** and to the conic side surface **14** by fastener **55** to provide greater strength and rigidity for the entire support structure. The support loops **45** extend upwardly a spaced distance above seat disk **32** when in its upwardly biased mode. My stool is useable without this support structure, though the support structure does add substantial ease and convenience to stool use.

Having described the structure of my stool, its use and function may be understood.

For use a stool constructed according to the foregoing specification is positioned on a supporting surface in a location for use. A user grasps one or both support loops **45** in the upper portion and uses those structures for guidance and partial support to aid in entering upon seat disk **32**. As the user is seated the seat disk **32** moves downwardly against the bias spring responsive to the user's weight. This seat disk motion responsively compresses spring **12** by moving upper spring plate **35** downwardly upon the upper portion of the compression spring **42** to create compressive force in the spring. The downward motion of the seat disk **32** will

be stopped when the lowermost portion of fastener 36 contacts the upper surface of top 15 of the base 10, if the seated weight of the user is sufficient to depress the seat disk 32 this far.

5 As the user's weight becomes supported by compression spring 42 and bottom disk 21, the downward force ultimately will be supported by caster wheels 27 resting on the underlying supportive surface. As this occurs, the upper arm 24a of wheel bracket 24, which has 10 some resilient deformability, will move upwardly until the lower surfaces of base ring 16 and bottom disk 21 of the base 10 are supported on the underlying supportive surface to provide positionally maintainable support of the stool while the user remains seated on the 15 stool. The stool in this condition then may be used as a support while the user remains seated.

If the user desires that seat disk 32 should not move upwardly above its lowermost position to relieve the effects of spring bias for more comfortable usage, 20 fastening lever 37 may be operated to pivot fastening finger 41 into the orifice defined by ring 36b of fastener 36 and the seat will be positionally maintained by the fastening lever.

Normally spring 12 will be configured as known in 25 the compression spring art to move downwardly to bring support disk 32 to its lowermost position, with fastener 36 resting substantially on truncating top surface 15 of the base 10 when a person of average weight is seated on

the seat disk 32. If the stool is to be used by a person substantially above or below an average weight, the compression springs 42 of the stool may be appropriately configured, pursuant to known compression spring art, to be positioned in the same downwardmost position when a person of the particular variant weight involved is seated on the seat disk 32. The stool however, is equally useable by a person of any weight without the fastener 36 being in fastening contact with the finger 10 41 of the fastening lever 37.

When a person seated on the stool is desirous of exiting from the stool, fastening lever 37 is released, if it is fastened, and the user moves to get up from the seat in the habitually familiar fashion, with or without 15 hand support on support loops 45. As this occurs the kinetic energy stored in spring 12 by reason of its compression will be released as the user moves upwardly from the stool and this kinetic energy will be transferred into a force tending to move seat 32 upwardly 20 to make it easier for the user to get up from the stool than would be possible without the release of the spring's kinetic energy. As the user removes himself from the seat disk 32 and from any substantial support 25 on loops 45, the retentant memory in the upper limbs 24a of wheel brackets 24 will cause those brackets to move downwardly to their initial unstressed position to responsively move caster wheels 27 downwardly to again support the stool on an underlying supportive surface

for motion of the stool thereover.

It is to be noted from the motions described for my stool in the seating and unseating processes that seat disk 32 will move substantially vertically upward and will not tip or tilt materially during its upward motion or thereafter. Any tipping or tilting motion, especially in a low stool such as the instant one, may cause a person exiting from a seated posture on the seat disk to lose balance and possibly fall in the process of exiting from the stool.

It is further to be noted that my stool may be used to perform its seating and unseating functions without use of either castor wheels or support structure 13.

The foregoing description of my stool is necessarily of a detailed nature so that a specific embodiment of its best known mode might be set forth as required, but it is to be understood that various modifications of detail, rearrangement and multiplication of parts might be resorted to without departing from its spirit, essence or scope.

Having thusly described my invention, what I desire to protect by Letters Patent, and

What I claim is: